

# **DEVICE AND METHOD FOR PLAYING A RING SIGNAL BASED ON A MEDIATE RING INFORMATION IN A COMMUNICATION APPARATUS**

## **FIELD OF THE INVENTION**

5 This invention relates to a device used in a communication apparatus; in particular, a device for generating a mediate ring information and playing a ring signal base on the mediate ring information.

## **BACKGROUND OF THE INVENTION**

10 The communication devices nowadays, such as telephones, cell phones and PDAs, provide various kinds of ring signals and respond to different incoming calls from different calling parties by different ring signals. Therefore, the subscriber of the communication device can recognize the calling party by the ring signal. Please refer to U.S. Patent No. 5,481,599 and 5,854,826 for the related prior art.

15 The prior art pre-stores a variety of ring signals so that it can be responsive to different incoming calls. However, it takes a lot of memory of the communication device to pre-store a variety of ring signals. Also, the subscriber cannot edit the ring signals. Therefore, the prior art methods can not satisfy the subscriber's need for quality, variety and personalization.

20 Some prior art communication apparatuses have a recorder device for recording the external audio sounds into an audio signal and they can play a ring signal from the audio signal recorded. However, such communication apparatuses require a lot of memory capacity but provide limited kinds of ring signals with poor quality.

Some prior art communication apparatuses have ring-editing function. The users

input musical notes to edit the ring signals by an inputting device of the communication apparatus. Such method does not take a lot of internal memory, but it is time consuming. Furthermore, it is hard to edit complex ring signals.

5 The objective of the invention is to provide a device used in an communication apparatus, for converting the audio signals that take a lot memory into the mediate ring information that take little memory, and for playing a ring signal based on the mediate ring information. The mediate ring information can be edited by the subscriber for personalization.

## **SUMMARY OF THE INVENTION**

10 The invention provides a device, used in a communication apparatus, for converting the audio signals into the mediate ring information and playing a ring signal based on the mediate ring information. The mediate ring information can be edited by the subscriber.

15 According to a preferred embodiment of the present invention, the device, used in the communication apparatus, generates a mediate ring information and plays a ring signal base on the mediate ring information. The device comprises a receiving module, a processing module, an analyzing module, a first storage module, a second storage module and a playing module. The receiving module receives an audio digital signal. The processing module divides the audio digital signal into a plurality of sub-signals in a predetermined period, and respectively transfers the plurality of sub-signals into a plurality of sets of frequency spectrums. The analyzing module respectively retrieves at least one frequency with largest amplitude in each of the plurality of sets of frequency spectrums and stores the retrieved frequencies in series to generate the mediate ring information. The first storage module stores the mediate ring information. The second storage module stores a plurality of predetermined tone information. The playing module retrieves the mediate ring information and one of

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the plurality of predetermined tone information from the first storage module, generates the ring signal based on the retrieved mediate ring information and the retrieved predetermined tone information, and plays the ring signal.

5 The objective of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment, which is illustrated in the various figures and drawings.

### **BRIEF DESCRIPTION OF THE APPENDED DRAWINGS**

FIG. 1 is a block diagram of a device according to the present invention.

10 FIG. 2 is a flowchart of the signal converting and processing a according to the present invention.

### **DETAILED DESCRIPTION OF THE INVENTION**

15 The objective of the invention is to provide a device, used in a communication apparatus, for converting the audio signals into the mediate ring information and playing a ring signal based on the mediate ring information. The mediate ring information can be edited by the subscriber of the communication apparatus. The invention can satisfy the subscriber's need for quality and a variety of ring signals and personalization. The followings will detail describe the spirits and applications of the preferred embodiment according to the present invention.

20 Please refer to FIG. 1. FIG. 1 is a block diagram of a device 10 according to the present invention. The device 10 is used in a communication apparatus, not shown.

The device 10 generates a mediate ring information  $R_m$  and plays a ring signal  $R_f$  based on the mediate ring information  $R_m$ . The device 10 comprises a receiving module 11, a processing module 12, an analyzing module 13, a first storage module

14, a second storage module 15 and a playing module 16.

The receiving module 11 is for receiving an audio digital signal Ad. The processing module 12 receives the audio digital signal Ad from the receiving module 11 via a signal line 21. After receiving the audio digital signal Ad, the processing 5 module 12 divides the audio digital signal Ad into a plurality of sub-signals in a predetermined period, and respectively transfers the plurality of sub-signals into a plurality of sets of frequency spectrums.

In one embodiment, the processing module 12 respectively transfers the plurality of sub-signals into the plurality of sets of frequency spectrums by a Fast 10 Fourier transformation (FFT).

The analyzing module 13 receives the plurality of sets of transferred frequency spectrums via a signal line 22. The analyzing module 13 retrieves at least one frequency with largest amplitude in each of the plurality of sets of frequency spectrums, respectively, and stores the retrieved frequencies in series to generate the 15 mediate ring information Rm. The mediate ring information Rm is stored in the first storage module 14 via a signal line 23. The second storage module 15 stores a plurality of predetermined tone information Rt. In contrast to the prior art that takes a lot of memory for storing ring informations, the mediate ring information Rm and the tone information Rt stored in the device 10 according to the invention occupy 20 little memory.

When the communication apparatus (not shown in drawings) receives an incoming call and plays the ring signal with the device 10, the playing module 16 of device 10 responds to the incoming call received by the communication apparatus. The playing module 16 retrieves the mediate ring information Rm from the first 25 storage module 14 via a signal line 24 and one of the plurality of predetermined tone information Rt from the second storage module 15 via the signal line 25. The playing

module 16 generates the ring signal based on the retrieved mediate ring information Rm and the retrieved predetermined tone information Rt. Then, the playing module 16 plays the ring signal Rf and the ring signal Rf is transmitted out via a signal line 26. The communication apparatus plays the ring signal Rf with a playing device such 5 as a speaker.

The predetermined tone information Rt stored in the second storage module 15 may comprise monotone, such as piano or trumpet, or chord. The first storage module 14 stores a plurality of mediate ring information Rm. The playing module 16 retrieves the mediate ring information Rm and the predetermined tone information Rt 10 base on the subscriber's 2 selection or prior configuration. The retrieved mediate ring information Rm can represent the music score of the ring signal. Therefore, the device 10 of the invention provides quality and variety of ring signals.

When receiving the incoming call, the communication apparatus sends a command to the playing module 16 via the signal line 27, as showed in FIG. 1. The 15 playing module 16 is triggered by the command to generate and play the ring signal responsive to the incoming call. The command comprises selection information for the mediate information Rm and the tone information Rt. Based on the selection information, the playing module 16 retrieves the mediate ring information Rm from the first storage module 14 and the tone information Rt from the second storage 20 module 15.

As showed in FIG. 1, the device 10 further includes an editing module 17 for personalization of the subscriber or user. The editing module 17 is capable of selectively editing the mediate ring information. After the mediate ring information Rm stored in the first storage module 14 and before the ring signal Rt played by the 25 playing module 16, the subscriber 2 of communication apparatus can edit the mediate ring information Rm by the editing module 17. By the way, the subscriber 2 of communication apparatus can edit the mediate ring information Rm according to

his/her requirement or preference.

To get a variety of audio digital signals Ad and to pre-stores a variety of mediate ring information Rm, the device 10 further comprises a recording module 18 and an analog/digital converting module 19. The recording module 18 is for recording an external audio source 3 into an audio analog signal, and transmitting the audio analog signal to the analog/digital converting module 19 via a signal line 29. The analog/digital converting module 19 is for converting an audio analog signal into a audio digital signal Ad, which can be received by the receiving module 11, and transmitting the audio digital signal Ad to the receiving module 11 via a signal line 30.

Following will describe the signal converting and processing of the device 10 according to the preferred embodiment of the invention. The signal converting and processing are used for a communication apparatus and to generate the mediate ring information Rm and play the ring signal base on the mediate ring information Rm. A plurality of the predetermined tone information Rt is provided in advance.

Please refer to FIG. 2. FIG. 2 is a flowchart of the signal converting and processing according to the present invention. According to the present invention, a method for generating a mediate ring information and generating a ring signal based on the mediate ring information in a communication apparatus comprises the steps of:

20 S41: receive the audio digital signal Ad.

S42: divide the audio digital signal Ad into a plurality of sub-signals in a predetermined period.

S43: respectively transfer the plurality of sub-signals into the plurality of sets of frequency spectrums.

S44: respectively retrieve at least one frequency with largest amplitude in each of the sets of frequency spectrums.

S45: store the retrieved frequencies in series to generate the mediate ring information Rm.

5 S46: wait for receiving the incoming ring by the communication apparatus.

S47: receive the mediate ring information Rm and one of predetermined tone information Rt.

S48: generate the ring signal based on the retrieved mediate ring information Rm and the retrieved tone information Rt.

10 S49: play the ring signal.

For the subscriber's personalization, between the S45 step and the S46 step the method further provides an editorial function to edit the mediate ring information Rm for the subscriber.

15 In one preferred embodiment, before the S41 step, the method comprises a step to record an external audio source into an audio analog signal and convert the audio analog signal into the audio digital signal. Therefore, the subscriber can get a variety of audio digital signals Ad, and hence pre-store a variety of the mediate ring information Rm. So, the subscriber of communication apparatus can edit the mediate information Rm according to her/her requirement or preference.

20 With the example and explanations above, the features and spirits of the invention will be hopefully well described. Those skilled in the art will readily observe that numerous modifications and alterations of the device may be made while retaining the teaching of the invention. Accordingly, the above disclosure

should be construed as limited only by the metes and bounds of the appended claims.